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(54) Horizontal centrifuge for an optimum oil extraction

(57) A horizontal centrifuge comprising a plurality of water outlet nozzles (1) which cross the inlet head (16) disposed on the oily slurry supply side, a plurality of oil outlet radial nozzles (15) arranged on the drum (3), a plurality of oil outlet radial nozzles (12) which are located downstream of the circular barrier (13) created by the supplied slurry, and a plurality of baffle plates (2, 7, 9) whose function is to form an uniterrupted oil column which does not mix with water and solids.

In particular, the baffle plate (2) arranged upstream prevents oil to be discharged with water, and the central baffle plate (7) lets the oil pass through its apertures (21) and directs the muds towards the wall of the drum (3), separating them from the oil column (8) and moving them away from the inlet apertures of the nozzles (12).

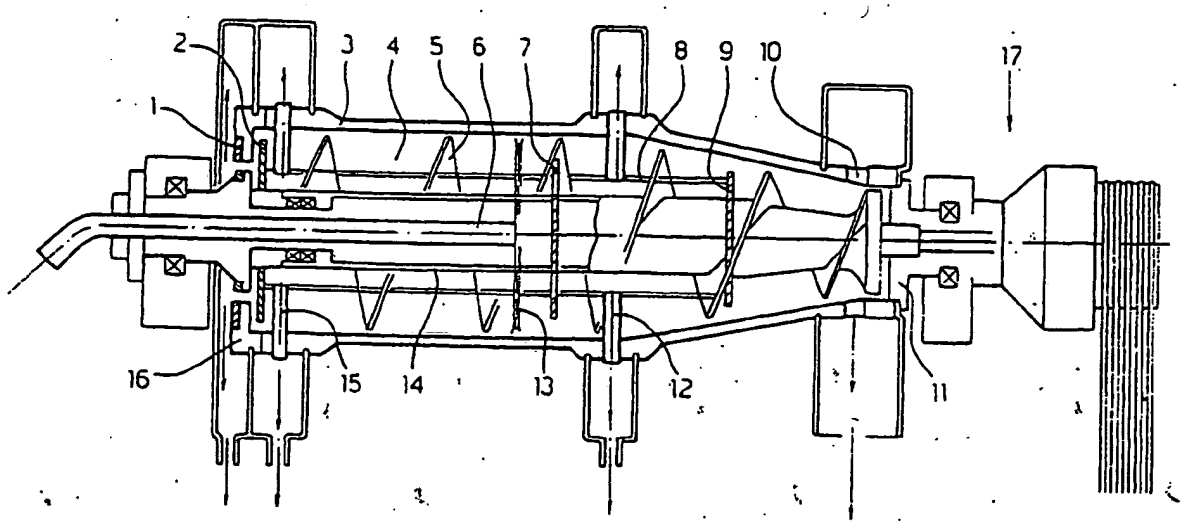

FIG. 1

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Description

The present invention relates to a horizontal centrifuge or "decanter" for oil extraction from an oily slurry obtained through the processing of olives or other oily fruits, and in particular it relates to a centrifuge in which the arrangement and/or the configuration of the baffle plates and the arrangement of the extraction nozzles, allow to realize optimum oil extraction conditions.

Horizontal centrifuges have been known for long; they operate according to a two-phase or a three-phase process. The centrifuges working according to a two-phase process are more advantageous since they do not require additional water during their operation and are therefore "ecological".

However the ecological centrifuges which have been produced until now, may be improved further with regard to the residual oil contained in the olive husks discharged through one of the centrifuge heads.
Moreover water and oil separation can be improved at the other centrifuge head which is located upstream. An object of the present invention is to find a solution for the above mentioned problems providing a centrifuge in which the location and the configuration of each baffle plate, the location of oil and water extraction nozzles with respect to these baffle plates, and finally the position of the oily slurry feed tube outlet with respect to both the baffle plates and oil extraction nozzles, are accurately chosen.
According to another aspect of the present invention, the residual oil percentage (proportion) is recovered from the olive husks using a single centrifugation process, carried out by means of a horizontal centrifuge of a special kind, which realized the separation in two successive steps, in two corresponding separate extraction chambers of the centrifuge.

The present invention will now be described with reference to two particular embodiments thereof, only for illustrative and non limitative purposes, wherein:

Fig. 1 is an axial longitudinal sectional view of the centrifuge of the present invention, according to the first embodiment;

Fig. 2 is a partial perspective view of the centrifuge shown in Fig. 1;

Fig. 3 is a sectional view along line A-A or B-B of Fig. 2;

Fig. 4 is a perspective view of the hollow shaft which supports the screw conveyor, according to the first embodiment;

Fig. 5 is a sectional view along line C-C of Fig. 4;

Fig. 6 is an axial longitudinal sectional view of the horizontal centrifuge of the present invention, according to a second embodiment.

With reference to Figs. 1 to 5, the horizontal centrifuge comprises a drum 3 with a cylindrical portion and a conical end; the latter could, if desired, also be cylindrical. A screw (auger) conveyor 5 is integral with a central hollow shaft 14, provided with usual apertures 20 (Fig. 4) allowing the passage of the oily slurry which is fed through the feed tube 6. An inlet head 16, associated to the side where the oily slurry is fed, closes the drum 3 from one of its sides, whereas an outlet head 11 is arranged on the opposite side of the drum 3, where the olive husks are discharged.

Moreover, mechanical means 17 are provided for the independent rotation of the drum 3 and the screw conveyor 5.

In conventional centrifuges, an oil column 8 is formed when the oily slurry (obtained from olives, etc.) is fed into the drum 3, due to the different specific weights of the components. In order to prevent the oil from being discharged together with the olive husks, according to the prior art, a baffle plate 9 has been provided, which stops the passage of oil towards the outlets for the olive husks 10. Therefore, the oil column 8 becomes stable.

In the centrifuge of the present invention, this oil is removed by means of the adjustable radial nozzles 15 arranged on the drum 3. Moreover, a baffle plate 2 is arranged immediately downstream of the inlet head 16. Water having a larger specific weight than oil 8 can get over this baffle palte 2, and it can be discharged through the nozzles 1 and the inlet head 16. The uninterrupted oil column 8 is formed therefore between the two baffle plates 2 and 9 acting as weirs.

The olive husks, which are even heavier, move more to the outside with respect to the shaft 14 of the screw conveyor, and are carried by the screw conveyor 5, towards the outlet nozzles 10.

Since the screw conveyor 5 - integral with the hollow shaft 14 - and the drum 3 rotate at high speed, the oily slurry coming out of the stationary tube 6, forms a circular barrier 13, while being projected in all directions in an orthogonal plane with respect to the hollow shaft 14. Moreover, since this barrier disappears only when feeding of the oily slurry obtained from olives etc. is stopped, the portion of the oil column 8 being formed on the right of said circular barrier 13, cannot migrate to the left and be discharged through the adjustable radial nozzles 15. In order to prevent this latter oil quantity from mixing with the olive husks and increasing their residual oil content, according to the invention other adjustable radial nozzles 12 are provided. These nozzles 12 are obviously located on the other side of the circular barrier 13, between the end of the tube 6 where this barrier is formed and the abov mentioned baffle plate 9.

Since the above described arrangement did not suffice to ensure an extraction of a sufficiently pure oil, through the nozzles 12, a central baffle plate 7 has been

applied - according to the invention - on the shaft 14 of the screw conveyor 5, between the outlet zone of the oily slurry from the feed tube 6, and the adjustable nozzles 12 for oil outlet. This baffle plate 7 serves as an obstacle for the muds (mixtures of oil-water-solids) which may form inside the drum between the oil layer 8 and the water layer 4, downstream of the outlet of the feed tube 6.

Otherwise, these muds would come out together with the oil, from the nozzles 12; since they are forced to get over the baffle plate and to be directed to a more external region, the muds reach this more external region of the centrifugation space together with the olive husks, and are discharged together with the olive husks, without being able to reach the inlets of the nozzles 12, which are nearer to the shaft 14.

According to the invention, the baffle plate 9 is not located immediately downstream of the radial nozzles 12, but it is arranged so as to be shifted towards the outlets 10, so that the oil can form a long stable and uninterrupted column 8, reducing the probability that the oil gets over the baffle plate 9.

According to the present embodiment, the baffle plate 7 has apertures 21 (Figs. 4 and 5) and has therefore no effect on the formation of the oil column 8, which settles inside the drum 3 between the baffle plate 2 and the baffle plate 9. From the continuity of the oil column 8, it follows that the oil extracted from the radial nozzles 12 and 15 has a purity degree which does not vary appreciably.

The advantage of the present centrifuge with respect to those which have been produced until now, is that with the arrangement of two sets of adjustable nozzles for the outlet of oil 15 and 12, which are installed in a radial position with respect to the drum 3, the first ones b ing disposed on the drum at equal angles near the inlet head where the slurry is fed and being separated therefrom by the baffle plate 2, the second ones being installed on the drum 3 at equal angles in the intermediate zone between the outlet of the tube 6 where the slurry comes out and the baffle plate 9, it can be ensured that the whole continuous oil column 8 which is formed due to its different specific weight with respect to water 4 and to the olive husks, can be conveyed by the adjustable nozzles 15, 12 to the outside of the drum, in the interior of appropriate containers, thereby ensuring the maximum recovering of the oil 8 which is present inside the drum 3, sensibly reducing in this way the residual oil in the olive husks.

Moreover, by arranging the baffle plate 9 not in the immediate neighbourhood of the radial nozzles 12, it can be ensured that the oil 8 will hardly get over this latter baffle plate 9 and the oil recover operation will be the best possible.

The present invention, according to this first embodiment, provides therefore a plurality of means which, when combined with each other, in the manner described and according to the particular arrangement shown, ensure an optimum extraction of substantially the same oil quality, for the same kind of olives and equal operative conditions. By providing the second set of nozzles 12 an optimum extraction of oil 8 can be ensured even on "the right" of the barrier 13. Since in this first embodiment the column 8 is uninterrupted, due to the fact that the intermediate baffle plate 7 has apertures 21, the oil extracted by the nozzles 15 and that extracted by the nozzles 12, will have very similar properties.

In the second embodiment (Fig.6), described in the following, it is possible that the oils extracted from the nozzles 12 and 15 have slightly different properties, because the baffle plate 7' is not pierced. In any case, in the second embodiment, which from different angles is similar to the first embodiment, the oil extraction is also carried out in an optimum way.

With reference to Fig. 6 (second embodiment), the description of components which are equal to those of the first embodiment and are denoted by the same numerals, will be omitted.

The central baffle plate 7' has been arranged on the shaft 14 of the screw conveyor 5, in order to form two separate chambers 22,23 inside the drum 3. This baffle plate 7' does not have apertures (the apertures 21 of baffle plate 7 in the first embodiment) and allows the passage of the olive husks from the first chamber 22 to the second chamber 23, and stops simultaneously the passage of oil from the chamber 23 towards the chamber 22. The feed tube 6 ends on the side of the chamber 22 with respect to the baffle plate 7', that is on the left of the baffle plate 7, in Fig. 6. The separation of the three substances "water-oil-olive husks" of the olive slurry is performed inside the chamber 22, said olive slurry being supplied by the feed tube 6. Because of the centrifugal force, the olive husks more towards the periphery, that is to the inner wall of the drum 3, and are carried by the screw conveyor 5, to the second extraction chamber 23.

The water contained in the olives, once the drum is filled, comes out of the nozzles 1 provided for this purpose, which maintain a constant level of this water, inside the drum. To this end, water "gets over" the baffle plate 2 which is arranged on the feeding side.

The oil, which has a lower specific weight with respect to water, settles between the water outflow level corresponding to the position of the nozzles 1, and the oil outflow level determined by the special adjustable nozzles 15 through which oil is discharged.

The baffle plate 2 which is arranged at the leading end of the shaft 14 of the screw conveyor, between the water outlet nozzles 1 and the oil outlet nozzles 15, prevents oil from flowing out together with water, and moreover, forces water to get over it before being discharged through the sp cial nozzles 1, as has been said before, during the description of the first embodiment.

In the second chamber 23, the olive husks containing the residual water and a reduced oil percentage, are dehydrated in the trailing zone of the drum 3.

The residual oil contained in the olive jusks forms a

ring inside the chamber 23, due to the centrifugal force, and flows out from the adjustable nozzles 12.

On the shaft 14 of the screw conveyor 5, another baffle plate 9 has been provided according to the prior art, as in the first embodiment, said baffle plate stopping the passage of oil which otherwise would be discharged together with olive husks. The olive husks are carried by the screw conveyor 5 towards the outlet 10 and are discharged to the outside.

Water recovered from the olive husks gets over the central baffle plate 7' and becomes level along the drum, flowing out of the nozzles 1.

In order to perform the washing of the second chamber 23, at the end of the process, so as to recover the oil quantity which is still present inside the second extraction chamber 23, a supply duct 24 is provided to let the washing water arrive in the interior of the second chamber 23.

The advantage of the present centrifuge with respect to those produced until now, is that by means of a single centrifuge it is possible to perform a two-step (double) extraction: oil is extracted from the olive slurry inside the first extraction chamber 22, and oil is extracted also from the olive husks, in the second extraction chamber 23. In other words, it is the same as if the olive husks coming from a centrifuge involving a single extraction, would be processed again inside a second centrifuge, with consequent econmical advantages.

It will be noted that the second embodiment (Fig. 6) has some aspects which are different from the first embodiment (Figs. 1-5). In particular, as has been already mentioned, the oil extracted from the second chamber 23, is likely to be slightly different from that recovered from the first chamber 22.

An aspect common to both embodiments, which must not be disregarded, is that the distance of the baffle plate 9 from the nozzles 12 must be great, this is very important, in order to prevent the muds which "get over" the baffle plates 7, 7', from immediately going beyond the baffle plate 9, rendering impossible the formation of a stable oil column between the baffle plates 7 or 7' and the baffle plate 9.

Claims

1. A horizontal centrifuge comprising a drum (3), a slurry inlet head (16) closing the upstream side of the drum (3), an outlet head (11) for the olive husks, closing the downstream side of the drum (3), a screw conveyor (5) arranged on a hollow shaft (14) rotatably mounted, and in a coaxial position, inside said drum (3), means (17) for independently rotating both the drum (3) and the hollow shaft (14), a stationary feed tube (6) of the oily slurry which passes through the inlet head (16) and ends inside the hollow shaft (14) provided with apertures (20) for the passage of the slurry, olive husks discharge outlets (10), a first baffle plate (9) which is integral with said hollow shaft (14) and prevents oil from being discharged together with the olive husks, water discharge nozzles (1) which are provided on the inlet head (16) and oil outlet nozzles (12, 15), characterized in that in order to improve at most the oil extraction capacity from the oily slurry, a long oil column is formed between said first baffle plate (9) and a second baffle plate (2) which is located immediately downstream of the inlet head (16); two sets of radial adjustable oil outlet nozzles (12, 15) being provided, in such a way that the first set (12) is arranged downstream of the feed tube (6) and the second (15) immediately downstream of said second baffle plate (2); the centrifuge being further characterized in that an element (7 or 7') is arranged between said feed tube (6) and said first nozzle set (12), in order to move away the muds from the extraction apertures of the nozzles (12).

2. A horizontal centrifuge according to claim 1, characterized in that said element (7) is a baffle plate integral with the hollow shaft (14), which plate is provided with central apertures (21) for oil passage, in order to allow the formation of a continuous oil column (8).

3. A horizontal centrifuge according to claim 1, characterized in that said first baffle plate (9) is located away from said first set of nozzles (12), in order to allow the formation of a long oil column and to take the maximum advantage of the inner centrifugation space of the drum (3), so as to obtain an optimum extraction.

4. A horizontal centrifuge according to claim 1, characterized in that the distance between the inner end of the second set of adjustable radial nozzles (15) and the hollow shaft (14), approximately corresponding to the thickness of the oil column at this location, is less than the height of the second baffle plate (2), so that the oil cannot get over this latter baffle plate.

5. A horizontal centrifuge according to any of the preceding claims, characterized in that said adjustable radial nozzles (12, 15) are arranged at equal angular distances around the drum (3).

6. A centrifuge according to claim 1, characterized in that said element (7') which is not provided with apertures, allows the passage of the olive husks from a first extraction chamber (22) to a second extraction chamber (23), and the passage of the residual water in the opposite direction, between the outer circumference of the baffle plate (7') and the inner wall of the drum (3).

7. A horizontal centrifuge according to any of the preceding claims, characterized in that it comprises a second tube (24) for supplying washing water, which is mounted along the feed tube (6) supplying the oily slurry and extends beyond the end of said feed tube (6) and beyond said element (7 or 7').

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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0001

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y,P	EP 0 704 248 A (NUOVA M.A.I.P.) * the whole document *	1,3-7	B04B1/20
Y	EP 0 140 672 A (THOMAS BROADBENT & SONS) * page 5, line 21 - page 6, line 18 * * page 8 * * figures 3,4 *	1,3-7	
A	EP 0 574 364 A (RAPANELLI FIORAVANTE) * column 3, line 21 - line 30 * * abstract; figures 3,5 *	1,2	
A	DE 32 02 294 C (WESTFALIA SEPARATOR)		
A	EP 0 018 474 A (HIGH)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 April 1997	Leitner, J

CATEGORY OF CITED DOCUMENTS

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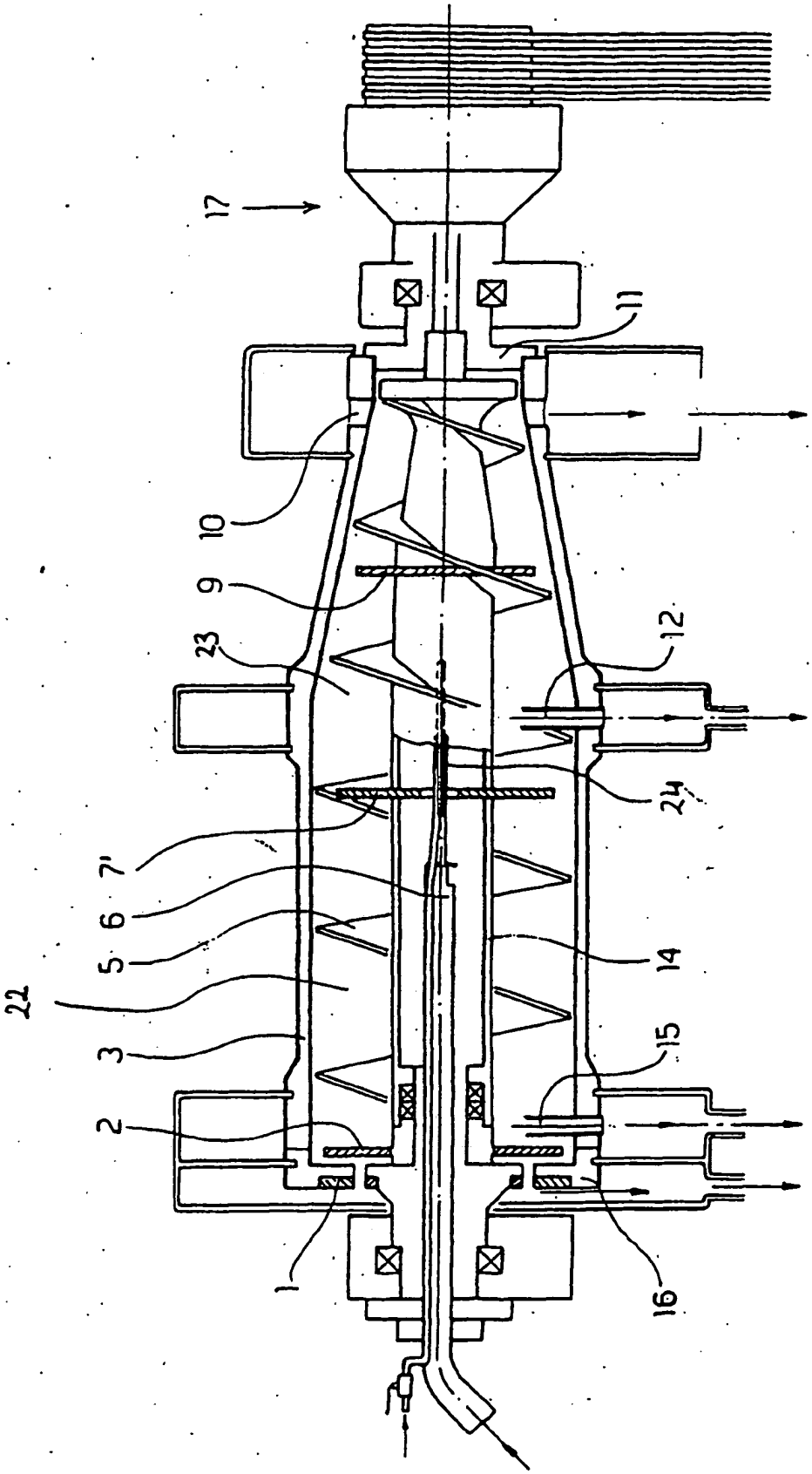

FIG. 6

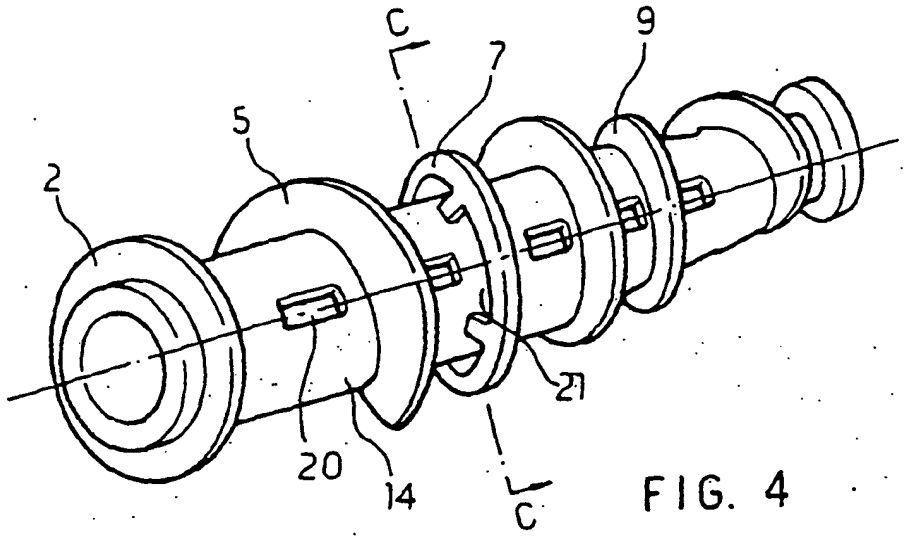

FIG. 4

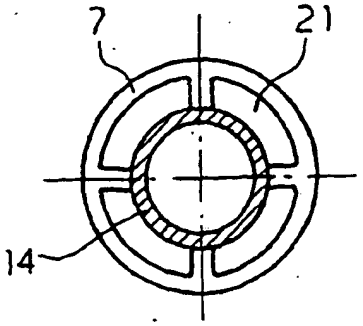

FIG. 5

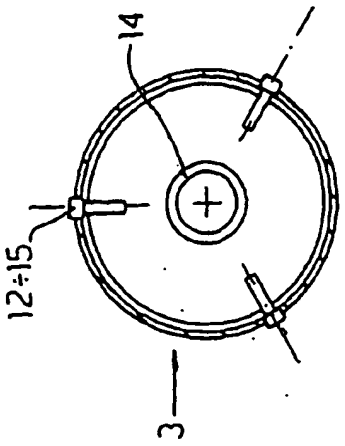

FIG. 3

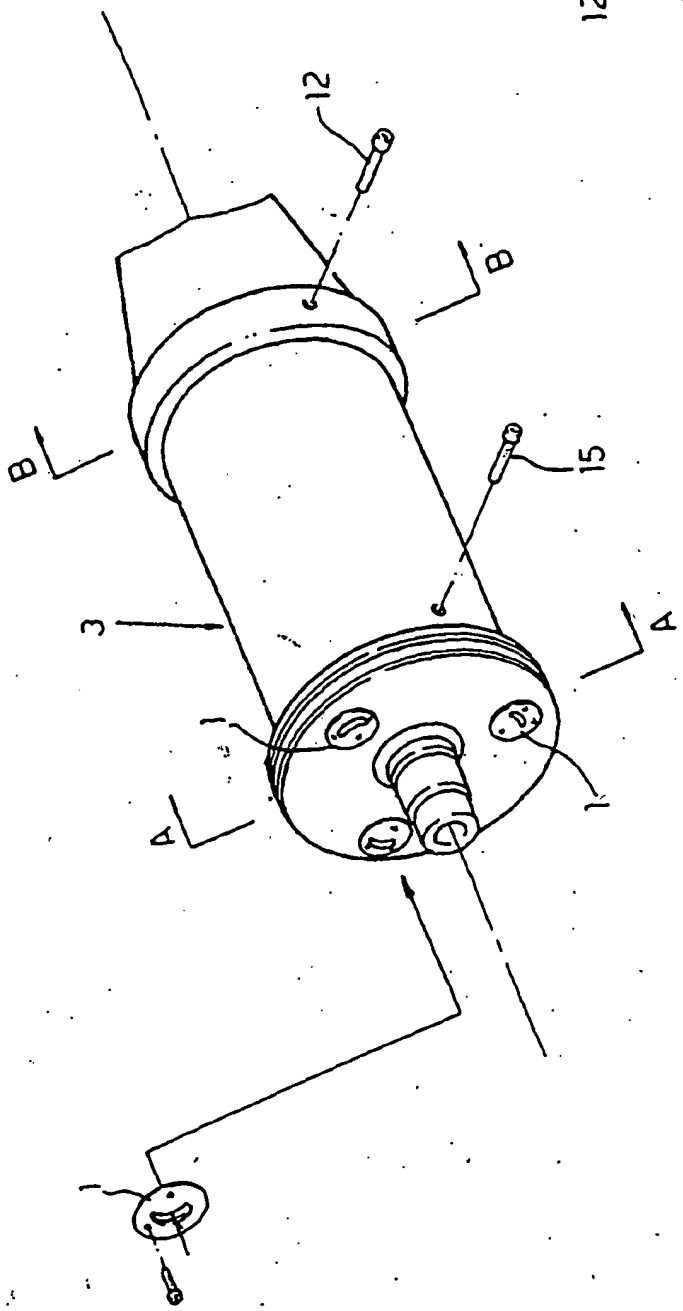

FIG. 2

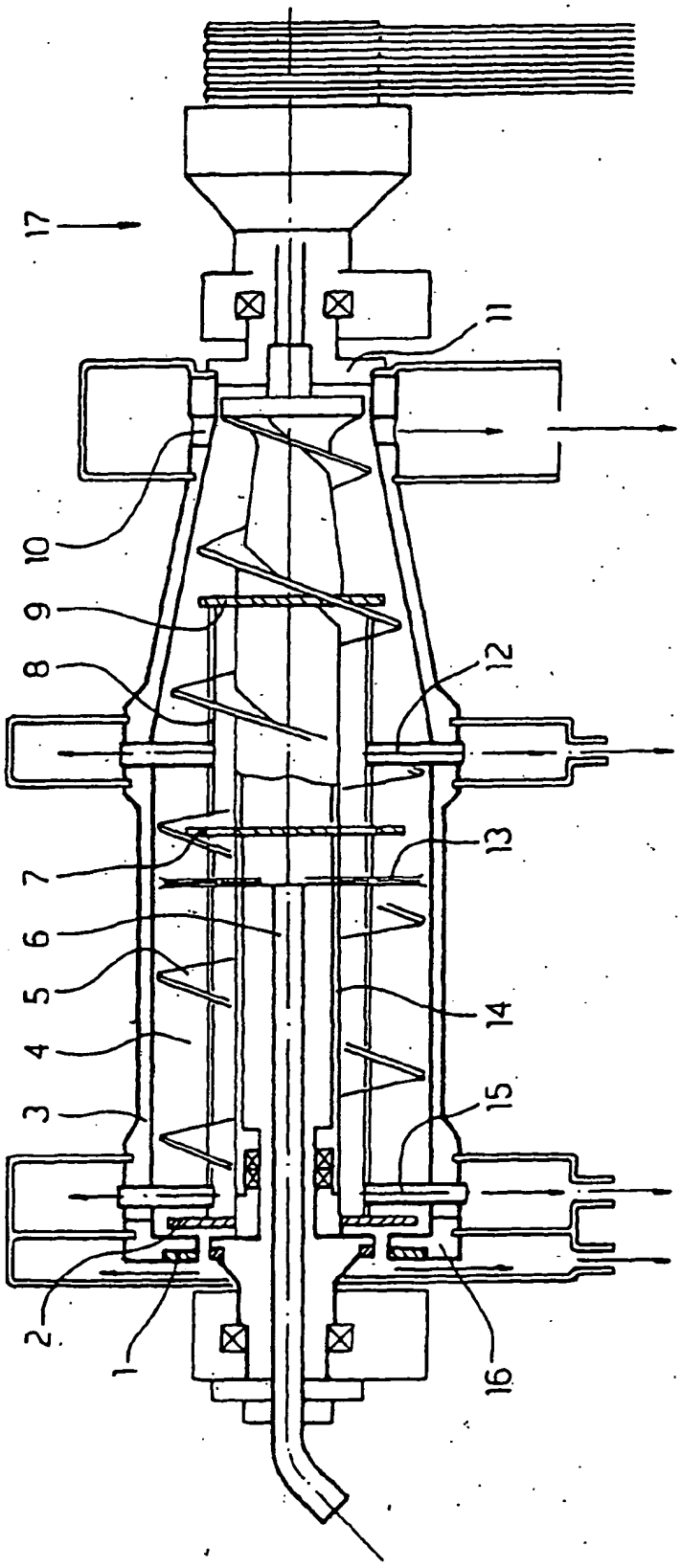

FIG.1